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ABSTRACT

Some of the psychological parameters of a student's educational environment which relate causally to the phenomenon of test anxiety are explored, as are the relationships of all of these factors to the student's academic performance. The study was based upon a person-environment concept of academic behavior. Particular interest centered upon the emotional state of anxiety in test situations, both as a consequence of the student's interaction with the educational environment, and as itself an influence upon academic performance. The students' perceptions of their educational environment and their personality characteristics were linked with test anxiety and performance in a causal model, the parameters of which have a sound empirical basis. The direct effects upon test anxiety and performance of the student personality characteristics, and their indirect effects through the students' perceptions of their educational environment were explored, and the relative magnitudes of all of these effects were estimated using path analysis. The resultant causal model supports the view that test anxiety is induced by an array of psychological variables, both directly and indirectly, and itself substantially affects academic performance in consequence. (Author/GK)

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TEST ANXIETY -

ITS CAUSES AND CONSEQUENCES

A systems approach to the study of the role of test anxiety in the academic performance of students in higher education.

FOURTH INTERNATIONAL SYMPOSIUM ON EDUCATIONAL TESTING,

ANTWERP, 1980.

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TEST ANXIETY - ITS CAUSES AND CONSEQUENCES

(A systems approach to the study of the role of test anxiety in the performance of students in higher education.)

INTRODUCTION

Practising educators who are concerned about the academic well-being of their students are well aware that one of the major problems encountered by a sizeable proportion of them, both successful and unsuccessful, is that of test anxiety - an apprehension about the experience of being assessed. Indeed few people would deny a degree of apprehension about the testing situations encountered in everyday life - school examinations, driving licence tests, etc. Sufficient is known about test anxiety and its relationship to human behaviour to enable us to recognize that the parameters of the issue are numerous, and that the relationships amongst those parameters are complex. Indeed, the phenomenon of test anxiety has well been described by some researchers as a veritable "can of worms".

A study of the pertinent literature immediately directs the researcher through a labyrinth of interlacing pathways. The results of studies of the influence of test anxiety on academic performance, for example, set up a confusing picture for the researcher, some studies showing a decremental effect, others an enhancing effect. In general, such studies have used simple regression analyses to explore the form of the relationships. In many cases the direction of the effect depends upon the magnitude of the experienced anxiety. In the few cases where curvilinear multiple regression has been used, it has become apparent that the relationship is probably more satisfactorily expressed as an inverse polynomial in which modest levels of anxiety promote performance, and excessive levels beyond a given threshold suppress it.

This study sets out to explore some of the socio-psychological parameters of a student's educational environment which relate causally to the phenomena of test anxiety and academic performance.

THEORETICAL FRAMEWORK

An adequate theory of anxiety must differentiate amongst the concepts of anxiety as a fundamental personality trait (trait anxiety), anxiety as an emotional state (state anxiety), and the stressful stimulus conditions which evoke such state anxiety. Spielberger's (1972) model shows the relationships amongst these constructs (Figure 1).

FIGURE 1 GENERAL ANXIETY MODEL

Trait Anxiety + Psychological Stress ⟶ State Anxiety

According to this model, state anxiety (i.e. the emotional experience of apprehension about a particular test situation) may arise from an inherent disposition to be anxious (trait anxiety) if the appropriate psychological stress pervades the individual's learning environment. Various theorists have attempted to conceptualize the nature of the psychological stress needed to induce anxiety. Caplan's (1965) model, for example, views stress as the result of the loss or threat of the loss of an individual's basic supplies: psychological (e.g. affection), socio-cultural (e.g. class harmony), and physiological (e.g. normal environmental temperature). In the model which serves as the theoretical framework for the present research, psychological stress is considered to be induced by a hostile educational environment, i.e. the socio-cultural element identified above. Furthermore, stress may also be induced in the individual by virtue of his own psychological structure, e.g. his lack of commitment to the learning experience in which he finds himself (i.e. non-involvement).

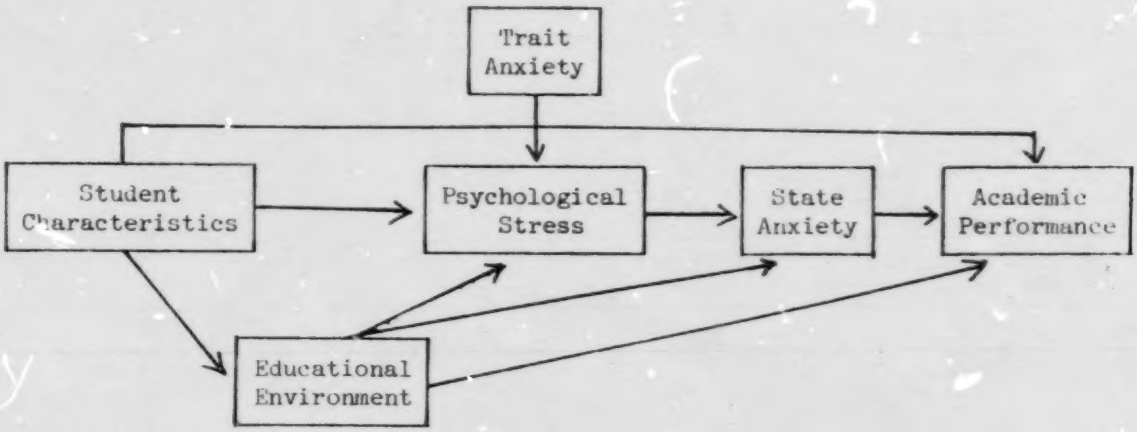
This study is based upon a person-environment concept of academic behaviour. Since the time of Lewin (1935) and Murray (1938), workers in many fields have made efforts to view human behaviour in transactional terms. Smith's (1960) social-interaction model of the teaching-learning milieu is one such approach, and forms the theoretical basis for this present study.

FIG. 2. In Smith's model the educational environment is perceived by the student in terms of his own personality. These perceptions are involved as mediating variables which govern the responses in terms of acquired knowledge, skills, attitudes and emotional states which a student may display. For the purposes of this research, Smith's concept of such interaction has been interpreted in terms of a linear and additive causal model, implying that student personality factors influence student performance as the student is exposed to the educational environment.

In the present study particular interest is centred upon the emotional state of anxiety in test situations, both as a consequence of the student's interaction with the educational environment, and as itself an influence upon academic performance. The students' perceptions of their educational environment and their personality characteristics are linked with test anxiety and academic performance in a causal model, the parameters of which have a sound empirical basis: (Fearn-Wannan, 1977; 1979a and 1979b).

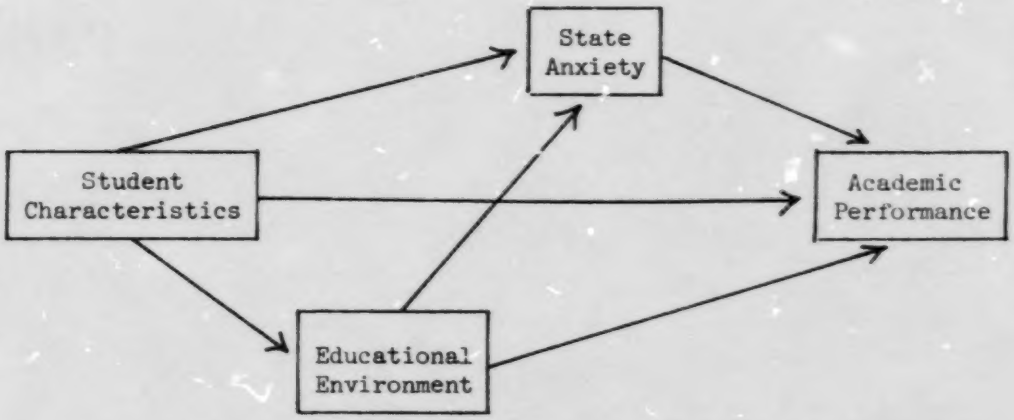
The model of the learning system based upon the foregoing notions therefore has the form shown in Figure 2.

FIGURE 2 MODEL OF LEARNING SYSTEM



Since no simple techniques are available for the assessment of trait anxiety or psychological stress, the model reduces to the form shown in Figure 3.

FIGURE 3 REDUCED MODEL OF LEARNING SYSTEM



Furthermore, the educational environment may be differentiated into perceived lecturer influences and perceived peer group influences. The particular form of state anxiety under investigation is test anxiety. Figure 4 shows the final model of the learning system used in this investigation.

This model is consistent with the state anxiety paradigm proposed by Phillips, Martin and Meyers (1972) as shown in Figure 5.

FIGURE 4 FINAL MODEL OF LEARNING SYSTEM

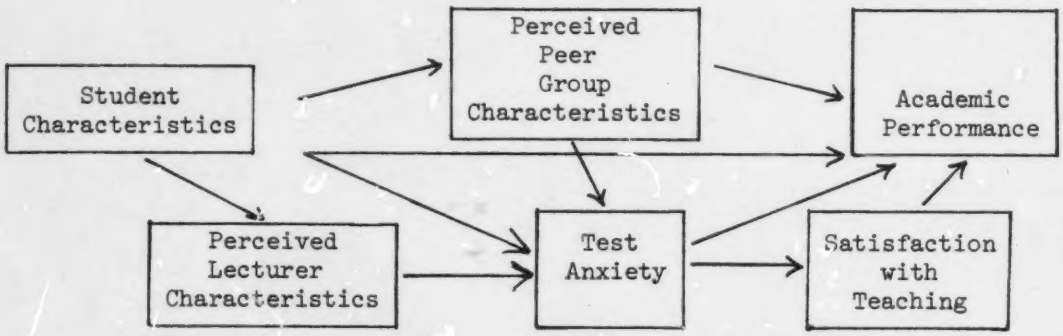
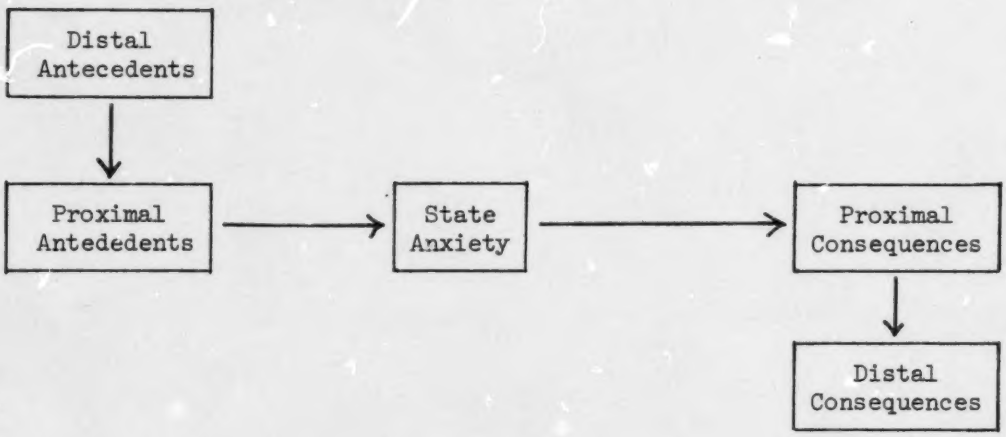


FIGURE 5 ANXIETY PARADIGM (Phillips, Martin and Meyers, 1972)



Student personality characteristics and lecturer and peer group influences are regarded as proximal antecedents in this model. Student cognitive performance, being a complex learning phenomenon which, it is hypothesized, is influenced by proximal consequences such as mental rigidity satisfaction with teaching, short-term memory, etc., is categorized as a distal consequence. The model shown in Figure 4 omits reference to the distal antecedents since measures of these variables were not available in this investigation.

LIMITATIONS OF THE MODEL

A linear model such as that shown in Figure 4 is, of course, deficient in at least two ways.

Firstly it ignores the possibility of feedback regression, i.e. that some of the later variables may, in fact, exert influences upon variables

occurring earlier in the causative model. [Consider, for example, the relationship between student achievement motivation and test anxiety. While it is possible to conceive of the student's level of achievement motivation influencing the level of test anxiety experienced, it is also possible to conceive of test anxiety reciprocally affecting the student's level of achievement motivation, i.e. a change in the former produces a proportionate change in the latter, which then induces a compensating proportionate change in the former. Such adjustments persist until a homeostatic state is established.

An analysis of the equilibrium condition existing between student personality characteristics and test-anxiety is attempted in Figure 8 (see Appendix).]

Secondly, no account is taken of the fact that the relationships within the model may, in some instances, be better represented as non-linear relationships. The introduction of polynomial and cross-product terms would, of course, greatly complicate the mathematics of the analysis. By overlooking these two problems it is clearly recognized that the model is probably an oversimplification of the true state of affairs. However, at this stage in the development of models of academic behaviour, it seems better to look for approximate relationships, despite the inaccuracies of the method, and to leave the refining of the models until later.

THE PARAMETERS OF THE MODEL

The perceived student and lecturer characteristics involved in this model are those which had emerged in earlier studies (Fearn-Wannan, 1977; 1979a; and 1979b) as meaningful within the context of higher education; i.e. accounting for at least 2.5% of the criterion variance. In the case of student personality variables the Student Biographical Inventory was constructed and validated to assess characteristics such as achievement motivation, conscientiousness, non-involvement, etc. The perceived lecturer variables were assessed by means of the Lecturer Description Index which included measures of inspiration, student-orientation, assertiveness, etc.

The other facet of the learning environment involved in this study was the perceived peer group influences. Group characteristics such as cliqueness, intimacy, friction, were assessed using an adaptation of Walberg's (1969) Learning Environment Inventory. Test anxiety was measured using a modified version of the State-Trait Anxiety Inventory (Spielberger, Garsuch and Lushene, 1970).

The sample population was the first-year class of students in Librarianship at the Royal Melbourne Institute of Technology, Australia, in 1979. Sixty-two students completed the two batteries of tests, and the academic performance scores in the subject, Librarianship Studies, were made available by the lecturer-in-charge as the criterion variable. Students' perceptions of his personality and lecturing style had previously been recorded by the students in the Lecturer Description Index.

PROCEDURE

The essential goal of causal models is to construct a simplified picture of reality in the sense that a model considers only a limited number of variables out of the learning milieu. Using the results of past research and current theory, where possible, the causal model is constructed in terms of a set of structural equations which represent the causal process assumed to operate amongst the variables under consideration. These equations, in turn, lead to parameter estimation.

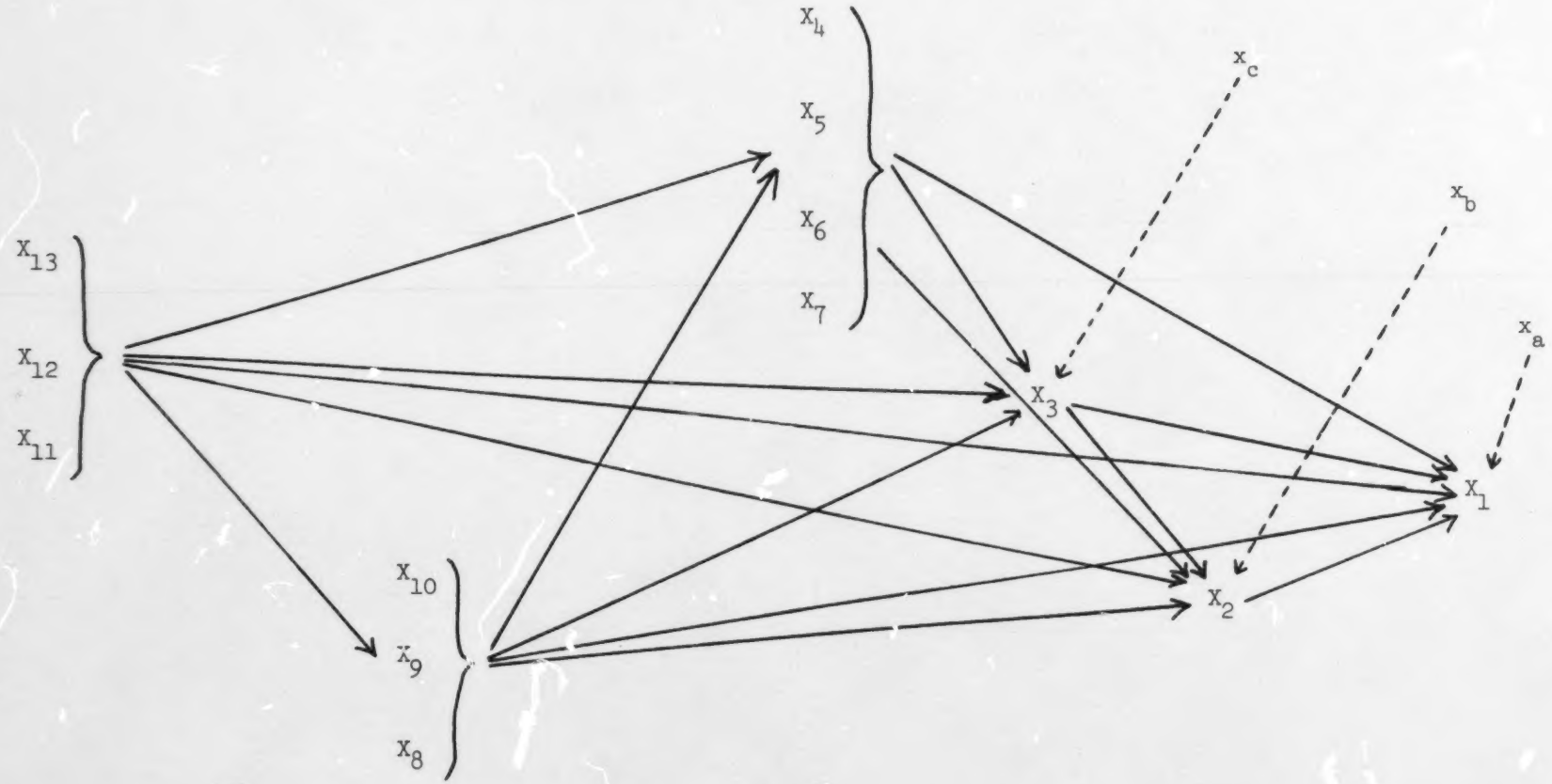
In this investigation ordinary regression methods (S.P.S.S. programme) were used to estimate the parameters in each equation separately. The path coefficients, which are the standardized partial regression coefficients relating a criterion and its predictors, were then calculated. Using the technique outlined by Alwin and Hauser (1975), the general effects of the causal variables, were then differentiated into direct and indirect effects.

A TEST ANXIETY MODEL

Figure 4 shows the general model of the learning system illustrating the hypothesised relationships amongst an array of variables related to test-anxiety.

We shall consider this test anxiety model as it is expressed in terms of the specific parameters considered in this investigation. It is depicted in Figure 6.

FIGURE 6 TEST-ANXIETY MODEL



VARIABLE CODE FOR TEST-ANXIETY MODEL - FIGURE 6

X_1	=	Academic Performance	
X_2	=	Satisfaction with Teaching	
X_3	=	Test Anxiety	
X_4	=	Cliqueness)	
X_5	=	Apathy)	Peer Group Influence
X_6	=	Intimacy)	
X_7	=	Friction)	
X_8	=	Assertiveness)	
X_9	=	Student-Orientation)	Lecturer Influence
X_{10}	=	Inspiration)	
X_{11}	=	Achievement Motivation)	
X_{12}	=	Non-Involvement)	Student Characteristics
X_{13}	=	Conscientiousness)	
x_a, x_b, x_c	=	residuals	

STRUCTURAL EQUATIONS

$$X_1 = P_{1,13}X_{13} + P_{1,12}X_{12} + P_{1,11}X_{11} + P_{1,10}X_{10} + P_{1,9}X_9 + P_{1,8}X_8 + P_{1,7}X_7 + P_{1,6}X_6 + P_{1,5}X_5 + P_{1,4}X_4 + P_{1,3}X_3 + P_{1,2}X_2 + \underline{P_{1,a}X_a}$$

$$X_2 \quad P_{2,13}X_{13} + P_{2,12}X_{12} + P_{2,11}X_{11} + P_{2,10}X_{10} + P_{2,9}X_9 + P_{2,8}X_8 + P_{2,7}X_7 + P_{2,6}X_6 + P_{2,5}X_5 + P_{2,4}X_4 + P_{2,3}X_3 + \underline{P_{2,b}X_b}$$

$$X_3 \quad P_{3,13}X_{13} + P_{3,12}X_{12} + P_{3,11}X_{11} + P_{3,10}X_{10} + P_{3,9}X_9 + P_{3,8}X_8 + P_{3,7}X_7 + P_{3,6}X_6 + P_{3,5}X_5 + P_{3,4}X_4 + \underline{P_{3,c}X_c} \text{ etc. etc.}$$

ESTIMATION OF THE TEST-ANXIETY MODEL

The observed correlations amongst the relevant variables are set out in Table 1. The path coefficients were calculated, and these are set out in Table 2. The specific causal model for this system is shown in Figure 7. The zero-order correlations implied by this model were then calculated. These are shown in Table 3.

It is apparent that some of the implied correlations are very rough approximations to the observed correlations (Table 1); e.g., the correlation between performance and perceived student apathy. On the other hand there is excellent agreement between others, e.g. the correlation between performance and non-involvement. This emphasizes the point made earlier that the representation of the system in linear terms may give a distorted view of the true state of affairs. Nevertheless, better an imperfect vision than no vision at all.

TABLE 1 OBSERVED CORRELATIONS AMONGST RESEARCH VARIABLES IN TEST-ANXIETY MODEL

	PER.	SATT.	TEST ANX.	CL.	AP.	IN.	FR.	INSP.	SO.	ASS.	C.	NI.	AM.
SATT.	0.13												
TEST ANX.	-0.25	-0.08											
CL.	-0.02	-0.22	0.13										
AP.	-0.31	-0.07	0.16	-0.17									
IN.	0.45	0.08	-0.13	0.00	-0.13								
FR.	-0.07	-0.07	-0.03	-0.47	0.09	-0.04							
INSP.	0.16	0.04	0.06	-0.16	-0.02	-0.01	-0.03						
SO.	0.18	0.24	-0.12	-0.05	-0.17	0.05	-0.12	0.07					
ASS.	-0.07	-0.10	0.10	0.15	-0.07	-0.12	0.01	0.05	-0.60				
C.	0.00	0.23	-0.44	0.01	-0.32	-0.19	0.18	-0.04	0.04	0.15			
NI.	-0.51	-0.02	0.19	0.05	0.11	-0.38	-0.08	-0.31	0.01	0.04	-0.39		
AM.	0.06	0.16	-0.35	-0.02	-0.38	-0.18	-0.04	0.16	0.09	0.08	0.81	-0.32	

TABLE 2 PATH COEFFICIENTS FOR THE RELATIONSHIPS AMONGST VARIABLES IN TEST-ANXIETY MODEL

PREDICTOR VARIABLE	DEPENDENT VARIABLE									
	ASS. (X_{10})	SO. (X_9)	INSP. (X_8)	FR. (X_7)	IN. (X_6)	AP. (X_5)	CL. (X_4)	ANX. (X_3)	SATT. (X_2)	PER. (X_1)
ACH. MOT (X_{11})	-0.13	0.11	0.38	-0.32	-0.07	-0.33	-0.06	0.08	0.09	0.17
NON-INVOLV. (X_{12})	0.11	0.10	-0.33	-0.02	-0.36	0.21	0.06	0.09	-0.17	-0.41
CONSCIENT. (X_{13})	0.30	0.08	0.38	0.44	0.01	-0.21	0.07	-0.48	0.48	0.08
ASSERT. (X_{10})				0.11	-0.09	0.17	0.09	0.21	-0.03	-0.11
STUD.-OR. (X_9)				-0.18	0.33	-0.04	-0.07	-0.01	0.26	0.22
INSPIR. (X_8)				-0.22	0.22	-0.01	-0.27	0.08	0.01	0.04
FRICTION (X_7)								0.26	-0.14	-0.14
INTIMACY (X_6)								-0.14	0.10	0.27
APATHY (X_5)								0.07	-0.19	-0.18
CLIQUENESS (X_4)								0.26	-0.27	-0.01
ANXIETY (X_3)									-0.13	-0.29
SATTCH (X_2)										0.10

FIGURE 7. SPECIFIC TEST-ANXIETY MODEL

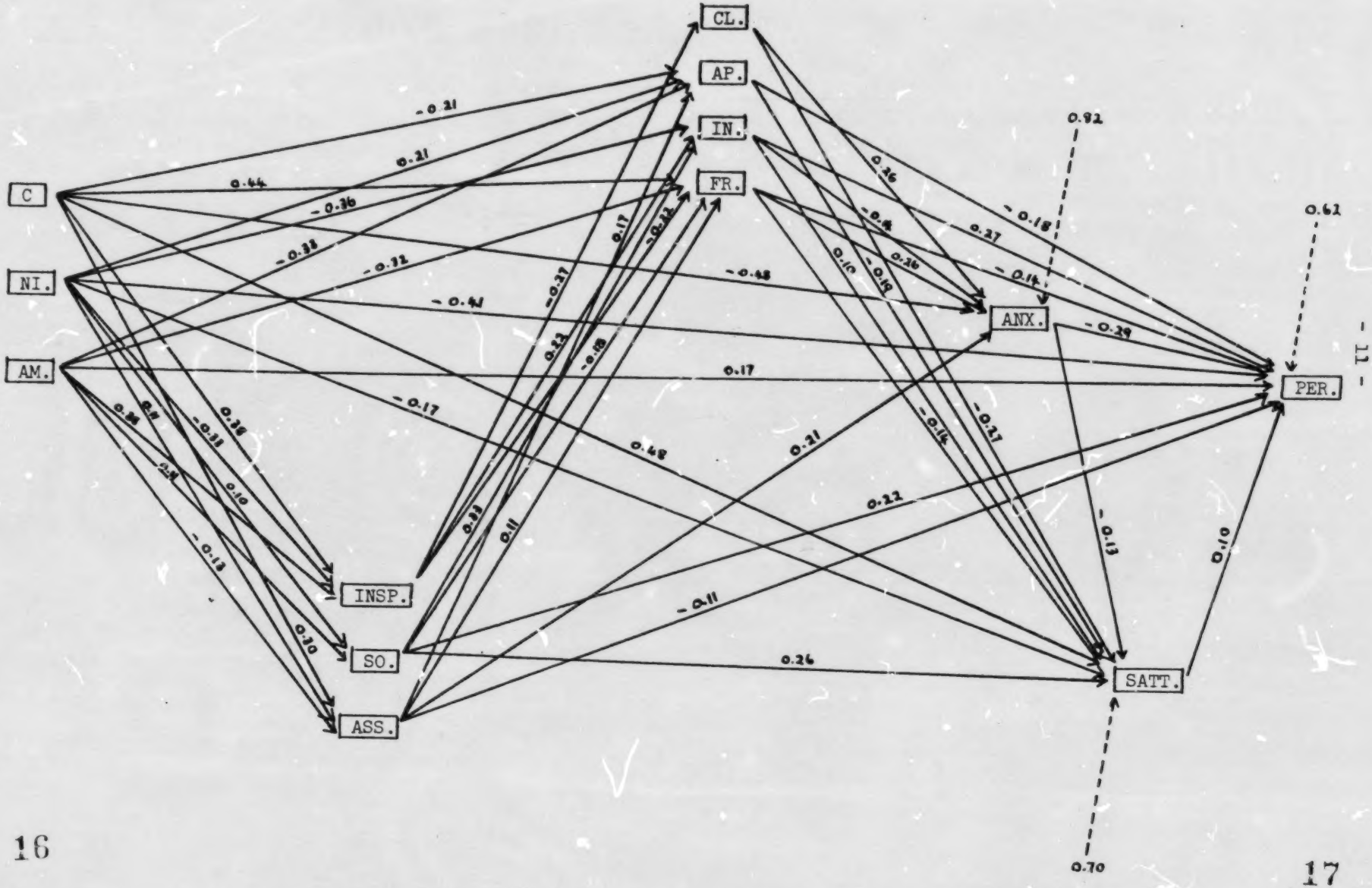


TABLE 3 IMPLIED CORRELATION MATRIX FOR TEST-ANXIETY MODEL

	PER.	SATT.	ANX.	CL.	AP.	IN.	FR.	INSP.	SO.	ASS.	CONS.	NI.	AM.
SATT.	0.10												
ANX.	-0.29	-0.13											
CL.	-0.10	-0.30	0.26										
AP.	-0.20	-0.19	0.00										
IN.	0.32	0.08	-0.14										
FR.	-0.23	-0.17	0.26										
INSP.	0.09	0.05	0.10	-0.27	-0.00	0.22	-0.22						
SO.	0.26	0.32	-0.01	0.00	0.00	0.33	-0.18						
ASS.	-0.22	-0.08	0.24	0.00	0.17	0.00	0.11						
CONS.	0.19	0.52	-0.37	0.00	-0.21	0.00	0.44	0.38	0.00	0.30			
NI.	-0.57	-0.22	0.07	0.00	0.21	-0.36	0.00	-0.33	0.10	0.11	0.00		
AM.	0.27	0.13	-0.11	0.00	-0.33	0.00	-0.32	0.38	0.11	00.13	0.00	0.00	

TABLE 4 CONTRIBUTIONS OF VARIABLES TO TEST ANXIETY

VARIABLE	TOTAL ASSOCIATION	DIRECT EFFECT	INDIRECT EFFECT	TOTAL EFFECT	NON-CAUSAL EFFECT
CL.	0.13	0.26	-	0.26	-0.13
AP.	0.18	0.07	-	0.07	0.11
IN.	-0.13	-0.14	-	-0.14	0.01
FR.	-0.03	0.26	-	0.26	-0.29
INSP.	0.06	0.08	-0.15	-0.07	-0.13
SO.	-0.12	-0.01	-0.09	-0.10	-0.02
ASS.	0.10	0.21	0.03	0.24	-0.14
CONS.	-0.44	-0.48	0.17	-0.31	-0.13
NI.	0.19	0.09	0.08	0.17	0.02
AM.	-0.35	0.08	-0.11	-0.03	-0.32

TABLE 5 DECOMPOSITION OF INDIRECT EFFECTS FOR TEST ANXIETY MODEL

VARIABLE	TOTAL INDIRECT EFFECT	INDIRECT EFFECTS VIA						
		CL.	AP.	IN.	FR.	INSP.	SO.	ASS.
INSP.	-0.15	-0.07		-0.03	-0.05			
SO.	-0.09			-0.04	-0.05			
ASS.	0.03				0.03			
CONS.	0.17				0.11			0.06
NI.	0.08			0.05				0.03
AM.	-0.11				-0.08			-0.03

TABLE 6 CONTRIBUTIONS OF VARIABLES TO PERFORMANCE

VARIABLE	TOTAL ASSOCIATION	DIRECT EFFECT	INDIRECT EFFECT	TOTAL EFFECT	NON-CAUSAL EFFECT
AM.	0.06	0.17	0.12	0.29	-0.23
NI.	-0.51	-0.41	-0.15	-0.46	-0.05
CONS.	0.00	0.08	0.14	0.22	-0.22
ASS.	-0.07	-0.11	-0.12	-0.23	0.16
SO.	0.18	0.22	0.15	0.37	-0.19
INSP.	0.16	0.04	0.09	0.13	0.03
FR.	-0.07	-0.14	-0.09	-0.23	0.16
IN.	0.45	0.27	0.05	0.32	0.13
AP.	-0.31	-0.18	-0.02	-0.20	-0.11
CL.	-0.02	-0.01	-0.11	-0.12	0.10
ANX.	-0.25	-0.29	-0.01	-0.30	0.05
SATT.	0.13	0.10	-	0.10	0.03

TABLE 7 DECOMPOSITION OF INDIRECT EFFECTS FOR PERFORMANCE MODEL

VARIABLE	TOTAL INDIRECT EFFECT	INDIRECT EFFECTS VIA								
		SATT.	ANX.	CL.	AP.	IN.	FR.	INSP.	SO	ASS.
ANX.	-0.01	-0.01								
CL.	-0.11	-0.03	-0.08							
AP.	-0.02	-0.02								
IN.	0.05	0.01	0.04							
FR.	-0.09	-0.01	-0.08							
INSP.	0.09					0.06	0.03			
SO.	0.15	0.03				0.09	0.03			
ASS.	-0.12		-0.06		-0.04		-0.02			
CONS.	0.14	0.05	0.14		0.04		-0.06			-0.03
NI.	-0.15	-0.02			-0.04	-0.10			0.02	-0.01
AM.	0.12				0.05		0.04		0.02	0.01

16.

Using Alwin and Hauser's (1975) technique, the direct and indirect effects of the predictor variables upon test anxiety were determined. These are shown in Tables 4 and 5.

Similarly the direct and indirect effects of the predictor variables upon performance were determined, and these are shown in Tables 6 and 7.

DISCUSSION

~~From Table 4 and 5~~ It can be seen that the most significant primary (DIRECT EFFECTS) causes of test anxiety from amongst the variables considered in this study were student conscientiousness, perceived peer group friction and cliqueness, and perceived lecturer assertiveness. Each of these variables contributed nearly 6.0% of the variance in the test anxiety scores. In terms of an added variance model, this means that together they explained about three-quarters of the total accounted variance of 33%. Other variables such as student non-involvement and achievement motivation, and perceived peer group intimacy exerted significant, but lesser, effects.

[redacted] Perceived peer group friction emerged as an important intervening variable in the causal pathway leading to test anxiety, mediating very high proportions of the indirect effects of student conscientiousness and achievement motivation, and lecturer inspiration and assertiveness (see Table 5). On the other hand, lecturer student-orientation appeared to exert no strong direct or indirect effects upon test anxiety (see Table 4), nor was it involved as a mediating variable in the test anxiety pathways (see Table 5).

As far as the performance model is concerned, (see Tables 6 ~~and 7~~) test anxiety exerted a strong negative influence, accounting for some 11% of the total variance (56%) explained by the model. Most of this influence is a direct one (path coefficient = -0.29) with a very small indirect effect (path coefficient = -0.01). However test anxiety mediates both TABLE 7 positive and negative indirect effects of other variables which appear to counterbalance each other to a degree in this instance. Student conscientiousness, for example, exerts a very strong indirect positive effect on academic performance via test anxiety (see Table 7), whereas an array of environmental negative effects partially neutralizes this.

It is, perhaps, worth noting that the total effect of test anxiety is overshadowed in magnitude in the performance model (see Table 6) by student non-involvement and lecturer student-orientation. In terms of an (see TOTAL EFFECT)

added variance model non-involvement accounts for 22%, and student-orientation 15% of the total variance (56%) explained by the performance model. Again an array of student personality and environmental influences make smaller, but significant, contributions.

Satisfaction with Teaching (SATT.) also contributes, but in a smaller way, to the performance model. [From the data set out in Table 6 it can be seen that] Its direct effect is modest (path coefficient = +0.10) and its indirect effect is zero. Again, however, this latter figure represents the sum of a set of counterbalancing positive and negative influences.

Finally, it should be pointed out that in about one half of the cases there are very substantial non-causal effects (see Table 6). These emphasize the inadequacy of linear models as a means of explaining the relationships amongst the variables used in this research. As was pointed out earlier, the use of the relatively simple mathematics of non-linearity seems justified in early attempts to come to grips with the complexities of these problems.

CONCLUDING COMMENT

These findings give modest support to the view that test anxiety plays an important role in determining the academic performance of students in institutions of higher education. Not only does it exert direct and indirect negative influences upon performance, but is itself a mediating variable for a range of student personality variables and environmental variables which determine academic performance.

It should also be emphasized that the contribution of each of the variables is small, but this is to be expected because academic performance, like any other facet of human behaviour, is a multivariate phenomenon to which each component variable makes a small contribution.

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ABSTRACT

TEST ANXIETY - ITS CAUSES AND CONSEQUENCES

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(A systems approach to the study of the role of test anxiety in the academic performance of higher education students.)

Practising educators who are concerned for the academic well-being of their students are well aware that one of the major problems encountered by a significant number of students, both successful and unsuccessful, is that of test anxiety; i.e. apprehension about the experience of being assessed.

This study explored some of the psychological parameters of a student's educational environment which relate causally to the phenomenon of test anxiety, and the relationships of all of these factors to the student's academic performance.

The study was based upon a person-environment concept of academic behaviour. Since the time of Lewin (1935) and Murray (1938), workers in many fields have made efforts to view human behaviour in transactional terms. Smith's (1960) social-interaction model of the teaching-learning milieu is one such approach, and forms the theoretical basis for this present study.

In Smith's model the educational environment is perceived by the student in terms of his own personality. These perceptions are involved as mediating variables which govern the responses in terms of acquired knowledge, skills, attitudes and emotional states which a student may display.

In the present study particular interest centred upon the emotional state of anxiety in test situations, both as a consequence of the student's interaction with the educational environment, and as itself an influence upon academic performance. The students' perceptions of their educational environment and their personality characteristics were linked with test anxiety and performance in a causal model, the parameters of which have a sound empirical basis. (Fearn-Wannan, 1977; 1979a; and 1979b)

The direct effects upon test anxiety and performance of the student personality characteristics, and their indirect affects through the students' perceptions of their educational environment were explored, and the relative magnitudes of all of these effects were estimated using path analysis.

The resultant causal model (figure 1) supports the view that test anxiety is induced by an array of psychological variables, both directly and indirectly, and itself substantially affects academic performance in consequence.